

Gasification of human waste via a microwave plasma discharge for SOFCs—gas cleaning, SOFCs and system thermodynamics

Introduction

Solid Oxide Fuel Cell systems are developed for producing electricity for the plasma gasifier and heat for drying the fecal matter. Research activities are taken up for the integrated system development

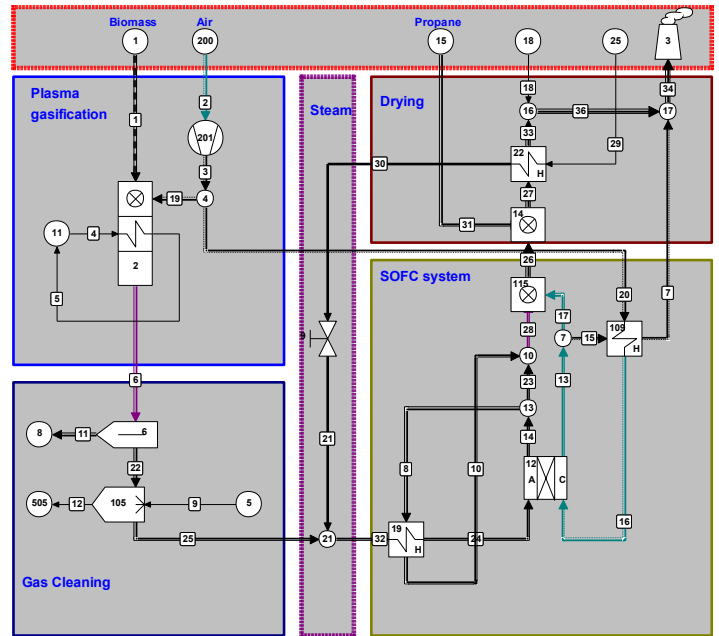
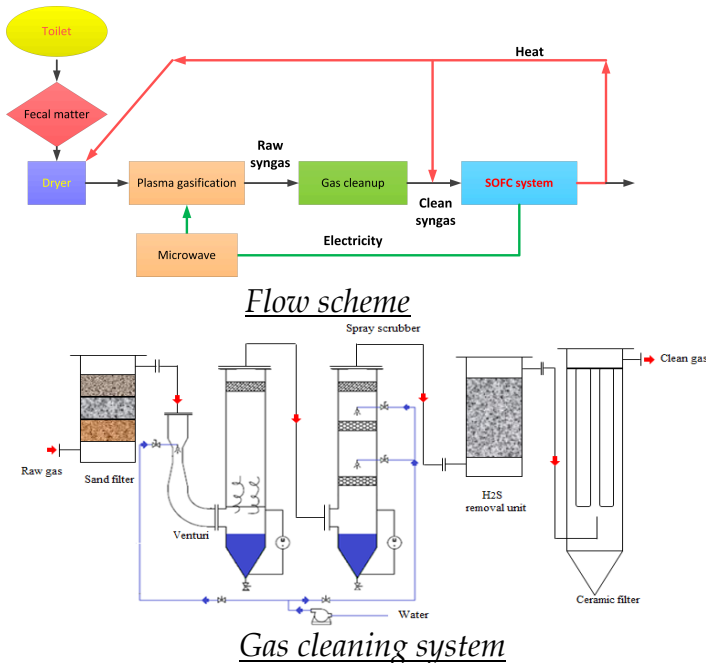
- ❖ SOFC contaminant tolerance studies
- ❖ Gas Cleaning Unit development
- ❖ SOFC subsystem development
- ❖ Integrated system energy and mass balance analysis
- ❖ System Optimization



SOFC system

System Calculations	
Input	Remark
Fecal matter composition	C, H, O, N, S, etc, and moisture content (40, 20 wt.%)
Operating conditions for gas cleaning	Low temperature, Pressure and temperature drops
SOFC operating conditions	High T, 800 °C, FU: 59%
Drying	80 wt. % dried to 40 or 20 wt. %

System layout and components



Preliminary indications from system calculations

- ❖ System self-sustained in electricity: 4.5 (power produced) vs. 3.5 kW (power consumed by the plasma), net electrical efficiency~8%
- ❖ Lowering moisture content down to 20 wt.% in fecal matter may require extra fuel input for providing more heat for drying
- ❖ System may self-sustained in heat if 40 wt. % moisture content is acceptable by the plasma gasification
- ❖ Other factors such as heat losses in plasma gasification, gas cleaning and SOFC system can affect the system performance

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